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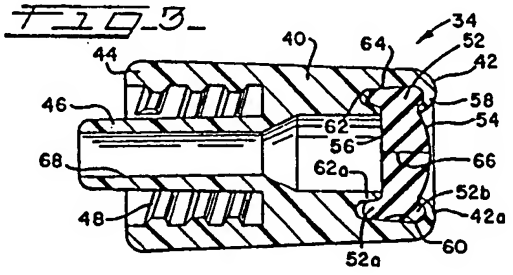
(54) Injection site.

(57) The injection site is usable with a blunt cannula and comprises a pre-slit septum (52) held in a housing (40). An end (42) of the housing is formed so as to serve as a retaining member and exerts axially directed forces on the septum to force its exterior surface (54) into an easily wipable domed shape. The housing also interacts with the septum to force the slit (66) into closed condition.

FIG 3



EP 0 544 653 A2

This invention relates to an injection site usable with a blunt cannula.

The prior art, as disclosed in Fig.1 of the drawings, comprises an injection site, usable with a blunt cannula and comprising a housing having a flow channel therethrough, b tween first and second ends and a resiliently flexible septum carried by the housing and sealing the first end, the septum having exterior and interior surfaces and an opening in the exterior surface through which a cannula can be passed for fluid communication with the flow path.

An injection site, usable with a blunt cannula, is also disclosed in US-4197848.

An object of the invention is to provide an easily wipable injection site which will reliably reseal even after many insertions of a blunt cannula.

The present invention provides that the first end of the housing is formed so as to force the exterior surface into a domed shape whereby the surface is easily wipable and whereby the septum interacts with the housing to force the opening into a sealed condition.

The septum may be a cylindrically shaped rubber member.

A retaining member may retain and deform the septum, the retaining member being, in one embodiment, generally U-shaped or, in another embodiment, formed as a coiled spring. The retaining member applies axially directed forces to the septum.

The injection site may have a void region, e.g. an annular channel, underlying the septum.

The retaining member deflects or distorts the upper and lower peripheral edges slightly as a result of applying axial forces thereto. When the blunt cannula is inserted into the slit in the septum, an annular interior peripheral region of the septum deforms further and fills, at least in part, the annular channel.

Deformation of this annular peripheral region may result in an insertion force in a range of 2.0 pounds (.7564 kilograms) to 5.0 pounds (1.891 kilograms). Preferably, the insertion force will have a value of the order of 2.0 pounds (.7564 kilograms).

The resealable opening in the septum can extend entirely through that member. Alternatively, the resealable opening can extend only partway therethrough. In this embodiment, the end of the blunt cannula will be used to tear through the remainder of the septum.

The septum can be formed in two parts. An exterior cylindrical portion can be slit completely. An interior cylindrical unslit portion can be provided to seal the site until the blunt cannula is inserted therethrough the first tim .

The interior surfac of the first nd can be formed with th taper in a range on the order of 5 degrees to 20 degrees. Preferably, the interior surface will have a taper on the order of 12 degrees. This tapered surface permits the use of a cylindrically shaped septum.

Brief Description of the Drawings

Figure 1 is a side elevational view, partly in section, of a prior art pre-slit injection site and an associated blunt cannula;

Figure 2A is a view in perspective of a catheter positioned in the hand of a patient with a pre-slit injection site in accordance with the present invention positioned adjacent thereto;

Figure 2B is a perspective view of the catheter of Figure 2A with a pre-slit injection site in accordance with the present invention rotatably affixed thereto;

Figure 3 is an enlarged side elevational view in a section of a pre-slit injection site in accordance with the present invention formed on a body having a luer twist-lock type connector for coupling to a catheter;

Figure 4A is an exploded view of a pre-slit injection site, a shielded blunt cannula and a syringe prior to being coupled together;

Figure 4B is an enlarged, side elevational view in section of the pre-slit injection site, the shielded blunt cannula and the syringe of Figure 4A coupled together to form a sealed fluid flow system;

Figure 5A is a view in perspective of a pre-slit injection site prior to engaging a blunt cannula carrying a locking member;

Figure 5B is an enlarged side elevational view, partly broken away, illustrating the interrelationship between the pre-slit injection site and the blunt cannula of Figure 5A;

Figure 6 is an overall view of a container, an associated solution administration set and a pre-slit injection site in accordance with the present invention;

Figure 7 is an enlarged side elevational view, partly broken away illustrating the relationship between selected elements of Figure 6;

Figure 8 is a side elevational view, partly broken away illustrating an alternate shielded cannula in accordance with the present invention;

Figure 9 is a side elevational view, partly in section, of a pre-slit injection site mounted on a fragment of a solution container;

Figure 10 is a side elevational view of a fragment of a solution container carrying, as a single port, a pre-slit injection site;

Figure 11 is a side elevational view of the injection site and the fragmentary container of Figure

10 prior to being engaged with a shielded cannula carried by a syringe;

Figure 12 is an enlarged side elevational view, partly in section, of a coupling system with a pre-slit injection site partly coupled to a blunt cannula;

Figure 13 is an enlarged sid el vational view, partly in section, of the coupling system of Figure 12 subsequent to engagement of the two coupling members;

Figure 14 is a side elevational view, partly broken away, of a spike connector carrying a pre-slit injection site in accordance with the present invention;

Figure 15 is an enlarged side elevational view of a Y-connector in section carrying a pre-slit injection site in accordance with the present invention;

Figure 16 is an enlarged fragmentary side elevational view in section of a coupling member carrying a pre-slit injection site where the slit extends only partway through the septum;

Figure 17 is a perspective view of a burette solution administration set carrying a pre-slit injection site in accordance with the present invention;

Figure 18 is a view of part of a burette solution administration set carrying a pre-slit injection site being coupled to a shielded blunt cannula;

Figure 19 is a step in the method of making a pre-slit injection site in accordance with the present invention;

Figure 20 is another step in the method of making a pre-slit injection site in accordance with the present invention;

Figure 21 is an initial phase of a final step in making a pre-slit injection site in accordance with the present invention;

Figure 22 is an intermediate phase of the final step in a method of making a pre-slit injection site in accordance with the present invention;

Figure 23 is a final phase of the final step in a method of making a pre-slit injection site in accordance with the present invention;

Figure 24 illustrates an initial phase in an alternate step of making a pre-slit injection site in accordance with the present invention;

Figure 25 illustrates a final phase of the alternate step in a method of making an injection site in accordance with the present invention;

Figure 26 illustrates yet another alternate step in a method of making a pre-slit injection site in accordance with the present invention;

Figure 27 is an enlarged, fragmentary cross-sectional view of another embodiment of an injection site in accordance with the present invention;

Figure 28 is a cross-section view taken generally along the plane 28-28 in Figure 27.

Detailed Description of the Preferred Embodiments

A prior art pre-slit injection site 10 and associated blunt cannula 12 are illustrated in Figure 1. The prior art injection site 10 has a cylindrical housing 14 with a fluid flow path 16 therethrough. A first end 18 of the housing 14 is closed with a relatively thin disc-shaped resealable member 20. The member 20 has a resealable opening 22 therein.

The member 20 is a molded septum with an integrally formed skirt 20a. The skirt 20a is oriented generally perpendicular to the portion of the septum with the opening 22.

The cannula 12 includes a body portion 24 which carries at a first end a hollow, cylindrical, blunt piercing member 26. As the cannula 12 is moved in a direction 28 toward the first end 18 of the injection site 10, the member 26 slidably engages the opening 22. The sealing member 20 is then deformed adjacent the opening 22 and the number 26 extends into the flow path 16. A fluid flow path through the cannula 12 will then be in fluid flow communication with the flow path 16 via the hollow piercing member 26.

In contradistinction to the prior art pre-slit injection site 10 of Figure 1, Figures 2A and 2B illustrate a pre-slit injection site 34 being coupled to a peripheral venous catheter 36. The catheter 36 is shown in fluid flow communication with a vein in a hand H of a patient. The catheter 36 carries at a proximal end 38 a luer-type female twist lock connector 41 .

The pre-slit injection site 34 is formed with a cylindrical housing 40 having a first end 42 and a second end 44.

Carried by the housing 40, adjacent the second end 44 is a hollow cylindrical fluid flow member 46. The member 46 slidably engages a receiving member in the housing 38 of the catheter 36, thereby providing a sterile fluid flow coupling as is well known and conventional.

A plurality of internal male luer-type threads 48 is carried by the housing 40 adjacent the second end 44. The threads 48 will engage the flange member 41 when the injection site 34 is rotated in a direction 50. When so coupled together, the catheter 36 and the injection site 40 provide a sealed coupling through which fluids may be injected into the vein of the hand H.

Figure 3 illustrates, in section, further details of the injection site 34. A resealable septum 52 is carried by the first end 42 of the housing 40. The septum 52 includes first and second spac d apart surfaces 54 and 56 respectively. The surface 54

has been forced into a dome-like shape by annular, U-shaped, swaged end members 58 carried by th first end 42. The dome-like shape of the surface 54 can extend beyond a surface 42a of the first end 42. This facilitates cleaning the surface 54.

The septum 52 has a generally cylindrical shape. The septum 52 can be formed of a latex or synthetic rubber material. Alternately, the septum can be formed of a thermoplastic elastomer. The material used for the septum 52 should be non-toxic and sterilizable such as by means of radiation, steam or Ethylene Oxide.

Because the septum 52 is generally cylindrical in shape, it can be die-cut from a sheet, cut from an extruded rod or molded. The septum 52 can have an exemplary diameter on the order of .30 inches (0.762 centimeters). The height of the septum 52 can be, for example, on the order of .125 inches (.3175 centimeters).

The first end 42 is also formed with a tapered interior surface 60 which terminates in an annular channel 62. The tapered interior surface 60 has a taper in a range of 5 degrees to 20 degrees. Preferably, the taper will be on the order of 12 degrees. With the indicated size of the above noted exemplary septum 52 and a 12 degree taper, diametric resealing compression of the septum 52 adjacent the channel 62 is on the order of 10%.

The channel 62 is bounded in part by a septum supporting ridge 62a. The channel 62 can typically have a depth in a range of .050-.070 inches (.127-.1778 centimeters).

A peripheral surface 64 of the septum 52 slidably engages the tapered interior surface 60 as the septum 52 slides into the first end 42. The annular channel 62 which underlies the interior peripheral surface 56 of the septum 52 is provided to permit the septum 52 to deform when a blunt cannula is inserted through an opening 66 therein.

The housing 40 is also formed with a fluid flow path 68 such that fluids injected via a blunt cannula inserted through the resealable opening 66 can flow into the catheter 36 for delivery to hand H of the patient.

The swaged end members 58 apply axial forces to the septum 52 thereby creating the domed exterior peripheral surface 54. The axial forces applied by the end members 58 slightly deform the regions 52a and 52b. In contradistinction, the tapered internal surface 60 applies radially directed forces to the septum 52, thereby forcing the opening 66 into a resealed condition.

Once the injection site 34 is lockingly engaged with the catheter 36, a sealed system is formed through which fluids can be infused into th cather 36. The resealable septum 52 closes the fluid flow path 68.

Figur s 4A and 4B illustrate in combination the injection site 34, a blunt shielded cannula 80 and a syringe of a conventional type 82. The syringe 82, as is well known, can be formed with a cylindrical hollow end 84 which carries a male luer-type twist lock thread 86. A hollow centrally located cylindrical fluid flow member 88 is in fluid flow communication with an interior region 90 of the syringe 82.

The shielded blunt cannula 80 carries at a first end 92 a female luer twist-lock flange 94. The flange 94 will slidably engage the threads 86 of the end 84. Hence, the shielded blunt cannula 80 can be locked to the syringe 82 forming a closed fluid flow pathway. The shielded cannula 80 could alternately be formed fixedly attached to the syringe 82.

The shielded blunt cannula 80 carries a cylindrical hollow protective shield 96 which surrounds a centrally located hollow, elongated cylindrical blunt piercing member 98. The cylindrical blunt piercing member 98 has a total length on the order of three times the thickness of the septum 52 in order to ensure complete penetration. The cylindrical blunt piercing member 98 has a diameter on the order of 1/3 the diameter of the septum 52. The shield 96 is desirable and useful for maintaining the piercing member 98 in an aseptic condition by preventing touch contamination prior to the shielded cannula 80 engaging the pre-slit septum 52. Also, the shield helps to align the piercing member with the pre-slit septum.

The cylindrical blunt piercing member 98 can slidably engage the pre-slit septum 52, best illustrated in Figure 4B, thereby extending through the preformed opening 66 therein. As illustrated in Figure 4B, when the piercing member 98 slidably engages and pierces the septum 52, the region 52a deforms by expanding into and filling, at least in part, the annular channel 62.

The deformation facilitates insertion of the piercing member 98 through the slit 66. Subsequent to the piercing member 98 slidably engaging the injection site 34, the interior region 90 of the syringe 82 is in fluid flow communication with the flow path 68 of the injection site 34 via flow paths 88a and 99 respectively of the syringe and the blunt piercing member 98.

In this engagement condition, the septum 52 seals completely around the piercing member 98. Hence, exterior gases, liquids or airborne matter will be excluded from the channel 68.

Subsequent to infusing fluid from the syringe 82 into the fluid flow pathway 68, hence into the catheter 36 and the hand H of the patient, the syringe 82 with lockingly engaged shielded cannula 80 can be slidably withdrawn from the injection site 34. Subs quent to this withdrawal, the septum 52 reseals the opening 66 ther in.

The opening 66 will repeatedly reseal, when the piercing member 98 is removed, provided that the pressure (in the septum 52 of the opening 66) created by interaction of the septum material properties and compression supplied by the housing exc eds the pressure challenge of the fluid contained within. Blunt cannula do not haphazardly core, lacerate, or otherwise damage the sealing interface 66 as conventional needles do, thereby allowing repeatable resealability. However, septum material properties, thickness, and compression allow resealability for a finite number of conventional needle insertions. The combination injection site 34 and catheter 36 then return to its pre-infusion, sealed condition.

Figures 5A and 5B illustrate the pre-slit injection site 34 used in combination with a blunt cannula 80a. The cannula 80a includes a hollow body portion 92a with a Luer flange 94a, a piercing member 98a, and manually operable elongated locking members 100a and 100b. Alternately, a tubing member could be affixed to the hollow body portion 92.

Curved end regions 100c of the members 100a and 100b slidably engage the second end 44 of the housing 40 when the piercing member 98a of the blunt cannula 80a has been forced through the preformed opening 66, best illustrated in Figure 5B. The embodiment illustrated in Figures 5A and 5B has the advantage that the infusion cannula 80a cannot accidentally disengage from the pre-slit septum 34 during the fluid infusion process. It will be understood that while spring-like deflecting members 100a and 100b are illustrated in Figures 5A and 5B that other forms of locking members are within the spirit and scope of the present invention.

Figure 6 illustrates an alternate pre-slit injection site 34a. A tubing member 102 can be fixedly attached to the cylindrical hollow fluid flow member 46. The embodiment 34a of Figure 6 utilizes the same structure for the septum 52 including the tapered surface 60 and the underlying annular channel 62 as does the embodiment 34 in Figure 3. The shielded cannula 80 can be utilized with the injection site 34a as previously described.

In the event that it is desirable to infuse solution from a container 104 with a connectional port 106, a fluid administration set 110 of a conventional variety may be utilized. The set 110 includes a spike connector 112 at a first end. The spike connector 112 is designed to pierce the port 106 of the container 104. The set 110 can also carry a slidably engageable connector 114 of a known type at a second end. As illustrated in Figure 7, the connector 114 can slidably engage the hollow cylindrical member 98 of the shielded cannula 80, thereby placing the interior fluid of the container 104 into fluid communication with the tubing m mber 102.

Figure 8 illustrates yet another alternate 80b to the shielded cannula 80. The piercing member 98b carries a tubing member 118 fixedly attached thereto. The tubing member 118 could be coupled at a second end to a container such as the container 104.

The present pre-slit injection site can be directly affixed to a container 120 as illustrated in Figure 9. The container 120 includes a rigid hollow cylindrical access port 122 affixed thereto. The access port 122 includes a fluid flow channel 124 in fluid flow communication with the interior of the container 120. Sealingly affixed to the port 122 is a pre-slit injection site 126.

The site 126 includes a cylindrical housing 128 which carries at a first end 130 a septum 132 with a slit 134 formed therein. The first end 130 has been swaged to form an annular U-shaped retaining member 136. The retaining member 136 in turn forms a domed exterior peripheral surface 138 on the septum 132.

The first end 130 also includes a tapered interior force applying surface 140 and an annular channel 142 underlying the septum 132. As discussed previously, the channel 142 provides a space into which the septum 132 can deform when a blunt cannula is forced through the resealable opening 134.

Further, as illustrated in Figure 9, the injection site 126 can be covered by a removable cover 146 of a type used with the conventional port 106 of the bag 120.

While the bag 120 is illustrated formed with two ports, the conventional pierceable port 106 and the pre-slit injection site 126, it will be understood that as an alternate (Figure 10), a container 150 could be formed which includes only the pre-slit injection port 126. The removable cover 146 could be used in combination with the container 150.

As illustrated in Figure 11, the pre-slit injection site 126 can be utilized for the purpose of injecting fluid from the syringe 82, coupled to the shielded cannula 80, into the container 150. When so utilized, the blunt piercing member 98 is used to place the interior fluid containing region 90 of the syringe into fluid flow communication with the interior of the container 150.

Figures 12 and 13 illustrate a fluid flow coupling system 151 having as a first element a pre-slit injection site 126a. The site 126a is the same as the site 126 except for a plurality of exterior threads 153 formed on an exterior peripheral surface 155 of the housing 128a. A second element of the coupling system 151 is a shielded blunt cannula 157.

The shielded blunt cannula 157 is sealingly affixed to a flexible tubing member 159 by means of a proximal hollow cylindrical member 161. The

member 161 xtends into a hollow cylindrical shield 163 to form a blunt piercing member 165.

The shield 163 carries, on an interior peripheral surface, a set of coupling threads 149. The threads 149 match the threads 153.

The two connector lements 126a and 157 slidably engage on another when the shielded cannula 157 moves in an axial direction 167 toward the injection site 126a. The blunt piercing member 165 penetrates the septum 132a.

The coupling member 157 can then be rotated in a direction 169 such the interior set of threads 149 carried thereon engages the exterior set of threads 153. As a result, the two coupling members 126a and 157 are lockingly engaged together with the insertion member 165 extending through the opening 134a in the septum 132a. Hence, fluids can flow from the container 150a via the connector system 126a and 157 through the tubing member 159 to the recipient.

Injection sites of the type described above are also usable in connection with other fluid flow coupling components. For example, with respect to Figure 14, a pre-slit injection site 160 of the type described above can be used in combination with a spike connector 162 of a conventional variety. Spike connectors such as the spike connector 162 can be used to pierce conventional ports such as the port 106 of the container 104 (Figure 6). When the spike connector 162 is so used, the pre-slit injection site 160 can then be utilized for the purpose of coupling to other fluid administration sets.

The injection site 160 illustrates an alternate form of swaging the first end 42c for the purpose of retaining the septum 52c therein. The first end 42c can be swaged so as to form an annularly shaped, spiral, spring-like member 164. The member 164 has a free end 164a which engages the exterior dome-shaped peripheral surface 54c of the septum 52c. The spiral, spring-like swaged member 164 will tend to uncoil, thereby continuously applying axial force to the septum 52c and maintaining the domed exterior peripheral surface 54c.

In yet another alternate, Figure 15 illustrates a pre-slit injection site 166 formed in a Y-junction member 168. The Y-junction member 168 is fixedly attached to first and second tubing members 170 and 172 respectively.

As an alternate to forming the slit 66d completely through the septum 52d, as illustrated in Figure 16, a slit 66e can be formed only partly through the septum 52e. Such a structure has the further advantage that, until used for the first time, the septum 52e is completely sealed.

The septum 52e can be formed in two parts. One part can have a slit, such as the slit 66e, xtending entirely ther through. A second part can be formed without a slit. Th se two parts can be located adjac nt on another in the first end 42e of the injection site.

The slit 66e may be longer on the top of th septum than the bottom. this feature aids blunt cannula alignment with the slit upon insertion, and aids resealability by minimizing the critical slit sealing interface area.

The slit could have a length with a range on the order of .03 inches (.0762 centimeters) to .150 inches (.381 centimeters). Preferably, a slit length on the order of .07 inches (.1778 centimeters) will be used in combination with a blunt cannula having a diameter on the order of .1 inches (.254 centimeters).

When initially used, the blunt cannula piercing member, such as the member 98, will be forced through the slit 66a. The lower peripheral surface 56e will then be punctured, providing access for the blunt cannula piercing member 98 into the fluid flow pathway 68e.

Pre-slit injection sites of the type described above can be utilized in combination with burette solution administration sets. One such set 176 Is illustrated in Figure 17. The set 176 includes a pre-slit injection site 178 of the type described above. The injection site 178 is affixed to an exterior planar surface 180 of the burette 182. A removable cover 184 can be used to maintain the injection site 178 in an aseptic condition until blunt cannula 186 or 188 is inserted therethrough.

Figures 19 through 23 disclose a method of making a pre-slit injection site in accordance with the present invention. In a first step, a housing 200 is provided. The housing 200 has an interior tapered surface 202 at a first end 200a therof. The interior peripheral surface terminates in an annular channel 204. A cylindrical septum 206 can be provided adjacent the end 200a.

In a second step, the septum 206 can be forced into the end 202a of the housing 200 and slightly deformed by the tapered peripheral surface 202 using an axially moving die 210. When positioned by the die 210, the septum 206 is located adjacent an internal annular right 212 which bounds the annular channel 204.

In a third step, a second die 214 can be utilized to swage the end 200a into spiral-shaped, spring-like members 200b which apply axially directed forces against an exterior peripheral surface 206a of the septum 206. The axially directed forces form the flat surface 206a into a domed exterior peripheral surface 206b as illustrated in Figure 23.

Simultaneously, with swaging the end members 200a so as to lock the septum 206 into the housing 200 and to form the domed exterior peripheral surface 206b, a knif 216 can be utilized to form a slit in the septum 206. Alternatively, the slit may be cut by a s parat die in a separate step. If

the septum 206 is formed as an extrusion, the slit can be cr ated during the extrusion process. If the septum 206 is formed by stamping from a rubber sheet, the slit can be cut during the stamping process. If the septum 206 is formed by compression molding, the slit can be cut during the trimming proc ss.

In order to extrude the slit into rod, a flat pin extrusion bushing can be used. A trailing ribbon may be attached to the bushing. The ribbon would prevent curing material across the slit. The ribbon or wire could be placed in the rod core and later stripped out leaving a slit. An inert substance, such as silicone oil, could be coextruded in the center of the rod to prevent curing across the slit and provide lubrication and a visible target for cannula insertion.

Figures 24 and 25 illustrate alternate swaging steps wherein a die 220 moving axially toward the housing 200 swages the end region 200a so as to form an annular U-shaped region 200c and the exterior domed peripheral surface 206c.

The dies 214 or 220 can be formed with various alternate shaped swaging surfaces 224, as illustrated in Figure 26, depending on the precise shape of the end swage which is desired. It will be understood that all such variations in the swaging operation are within the spirit and scope of the present invention.

The injection site configuration need not be limited to the configurations depicted in Figures 3 through 5B, 9, and 12 through 16. Rather, several configurations could be constructed without departing from the scope of this invention. Any such configuration would provide a flexible pre-slit sealing member captured in a housing which provides compression to create a seal against pressure and a void region to accommodate deformed portions of the sealing member material only when the material is deformed or displaced by a blunt cannula piercing member. One such possible configuration is depicted in Figures 27 and 28.

The blunt cannula may have various forms as disclosed in EP-A-0354947.

Claims

1. An injection site, usable with a blunt cannula, comprising a housing (40) having a flow channel (68) therethrough between first and second ends (42,46) and a resiliently flexible septum (52) carried by the housing and sealing the first end (42), the septum having exterior (54) and interior (56) surfaces and an opening (66) in the exterior surface (54) through which a cannula can be passed for fluid communication with the flow path, the opening being closable on removal of the cannula, CHARACTERISED IN THAT the first end (42) of the housing is formed so as to force the exterior surface (54) into a domed shape whereby the surface is easily wipable, and whereby the septum interacts with the housing to force the opening (66) into a sealed condition.

2. An injection site as in Claim 1 wherein a region (58) of said first end (42) is deformed and directed against said exterior surface (54) of the septum, thereby applying axially directed forces thereto and thereby forming said domed shape.

3. An injection site as in Claim 2 wherein said region is deformed into an axial force applying spiral spring-like member (164).

4. An injection site as in Claim 3 wherein the spring-like member (164) generates a force having an axially oriented component as it tends to uncoil.

5. An injection site as in Claim 2 wherein said region is deformed into an axial force applying annular U-shaped member (136).

6. An injection site as in any preceding claim including a void region (62) to accommodate deformed portions of the septum (52) as the blunt cannula (98) is inserted in said opening (66).

7. An injection site as in Claim 6 wherein the void region (62) is bounded in part by a septum supporting ridge (62a).

8. An injection site according to any preceding claim with said first end (42) of said housing defining a tapered interior surface (60), and with said septum comprising a cylindrical septum (52) positioned in said first end adjacent said tapered interior surface, said tapered interior surface (60) interacting with a peripheral surface (64) of said septum so as to generate radial resealing forces, directed inwardly toward a centerline of said flow channel, to urge said resealable opening into a sealed condition.

9. An injection site as in Claim 8 with said interior surface (60) having a taper in the range of 5 degrees to 20 degrees.

10. An injection site as in Claim 9 with said interior surface (60) having a taper of the order of 12 degrees.

11. An injection site as in any on of Claims 8 to 10 with said radial resealing forces increasing from a first value adjacent to said exterior peripheral surface (64) to a second, greater value displaced from said peripheral surface toward said second nd (46).

12. An injection site according to any one of Claims 8 to 11, wherein said void region is defined by an annular channel (62) underlying the tapered surface (60).

13. An injection site as in any one of Claims 7 to 12, including means (58) engaged with the peripheral surface (64) of the septum (52) to retain the septum in the housing (40).

14. An injection site as in any one of Claims 7 to 12, wherein the septum (52) is slidable in engagement with the tapered surface (60).

15. An injection site as in any preceding claim wherein said resealable opening (66) extends at least partway through said septum.

16. An injection site as in any one of Claims 1 to 14, wherein said resealable opening (66) extends entirely through said septum.

FIG. 1
PRIOR ART

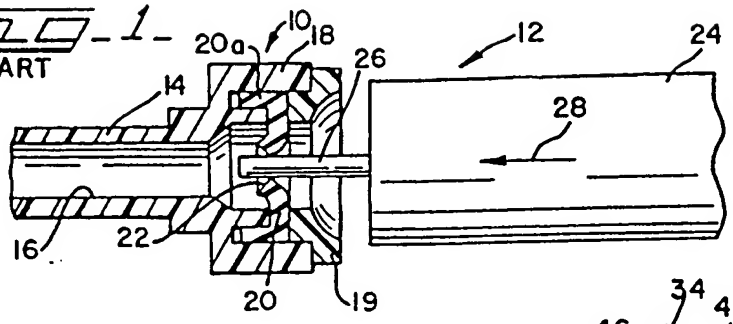


FIG. 2A

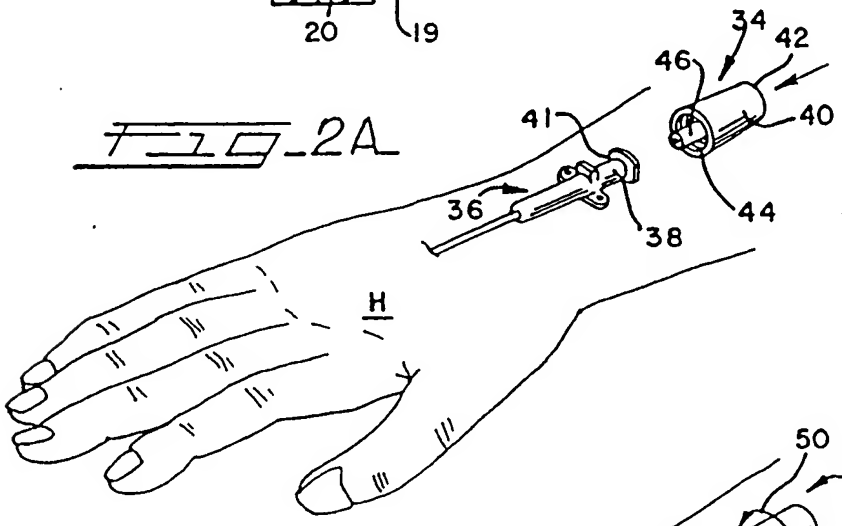


FIG. 2B

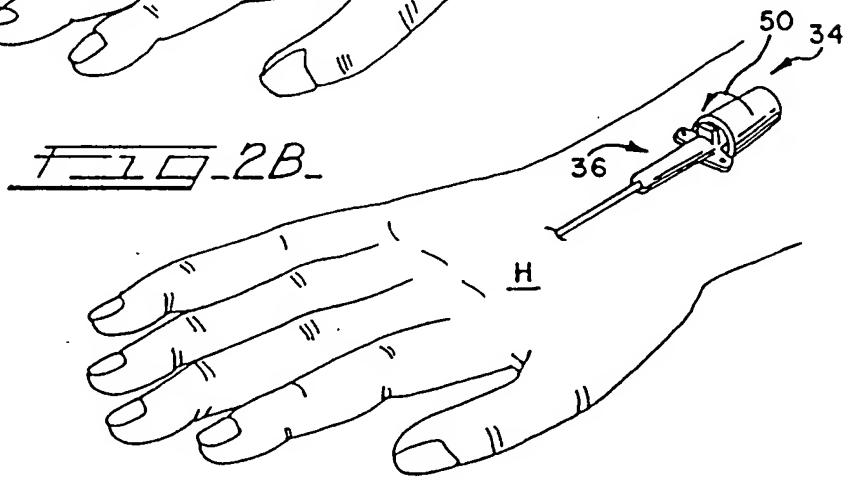


FIG. 3

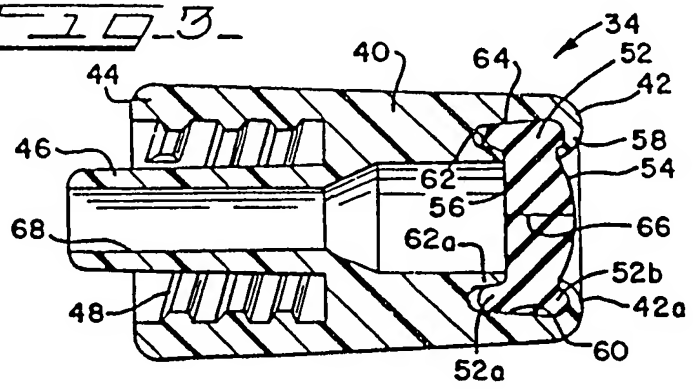


FIG_4A

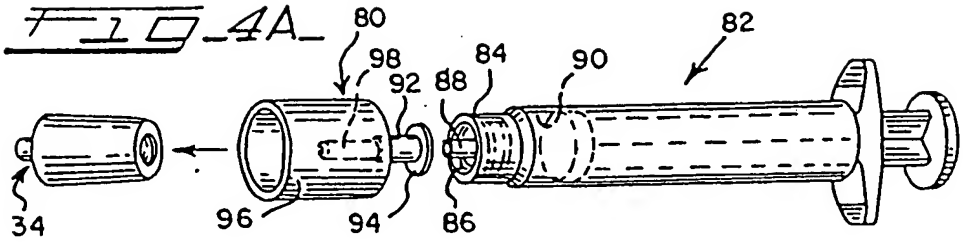


FIG_4B

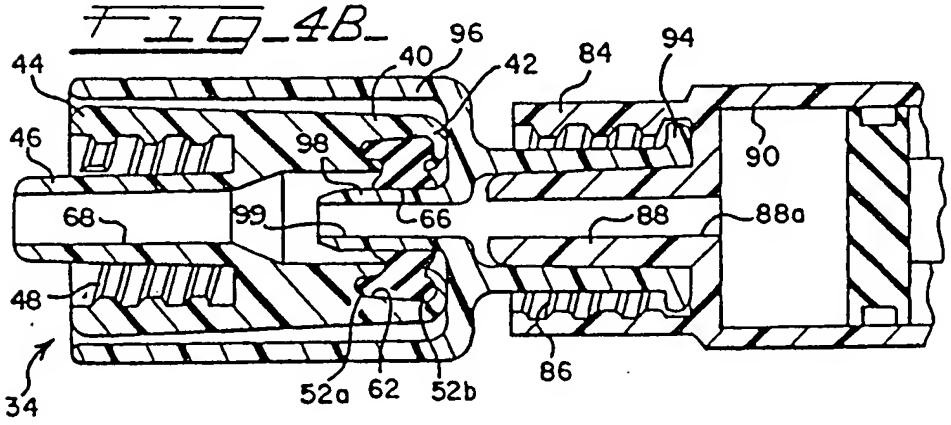


FIG_5A

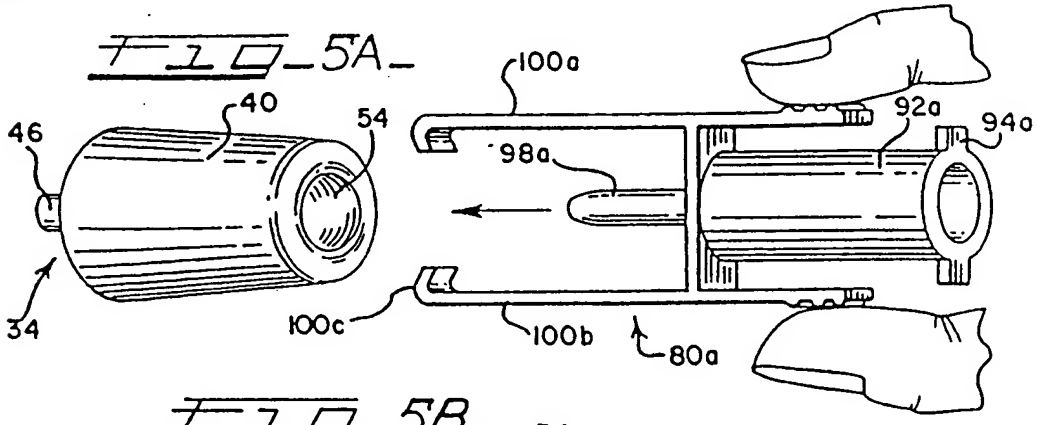


FIG_5B

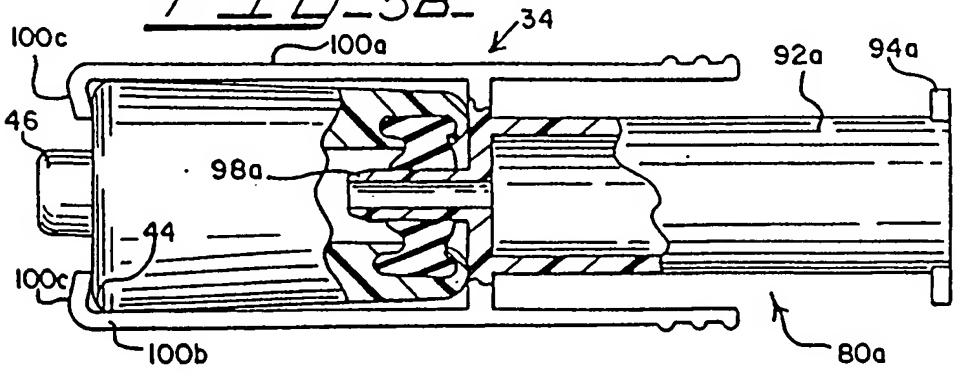


FIG. 7

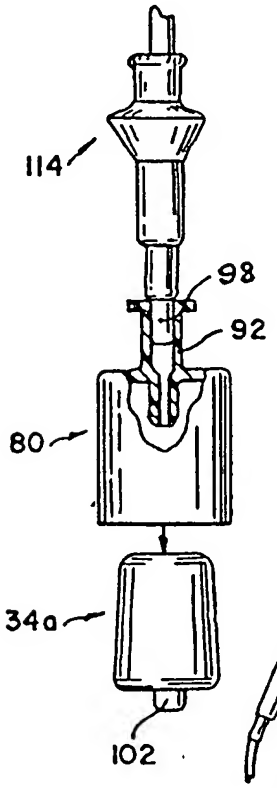
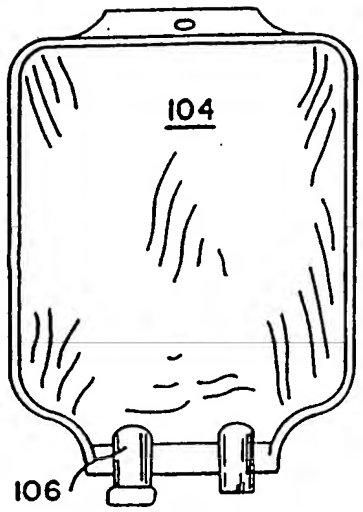


FIG. 6



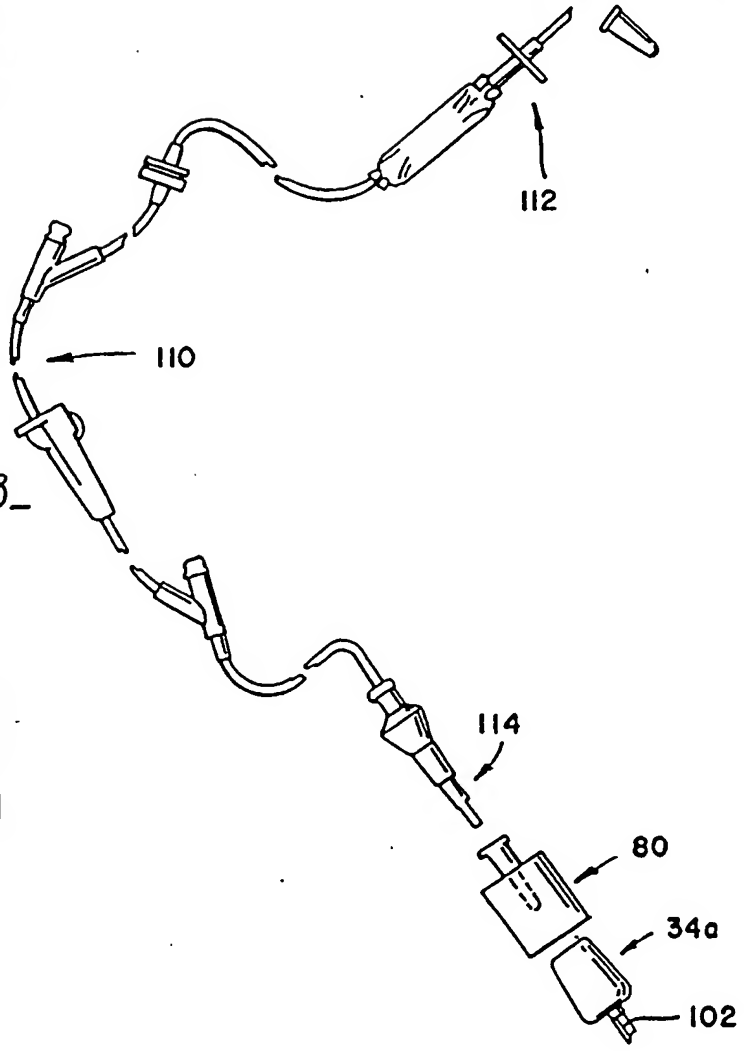


FIG. 8

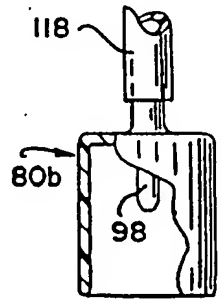


FIG-9

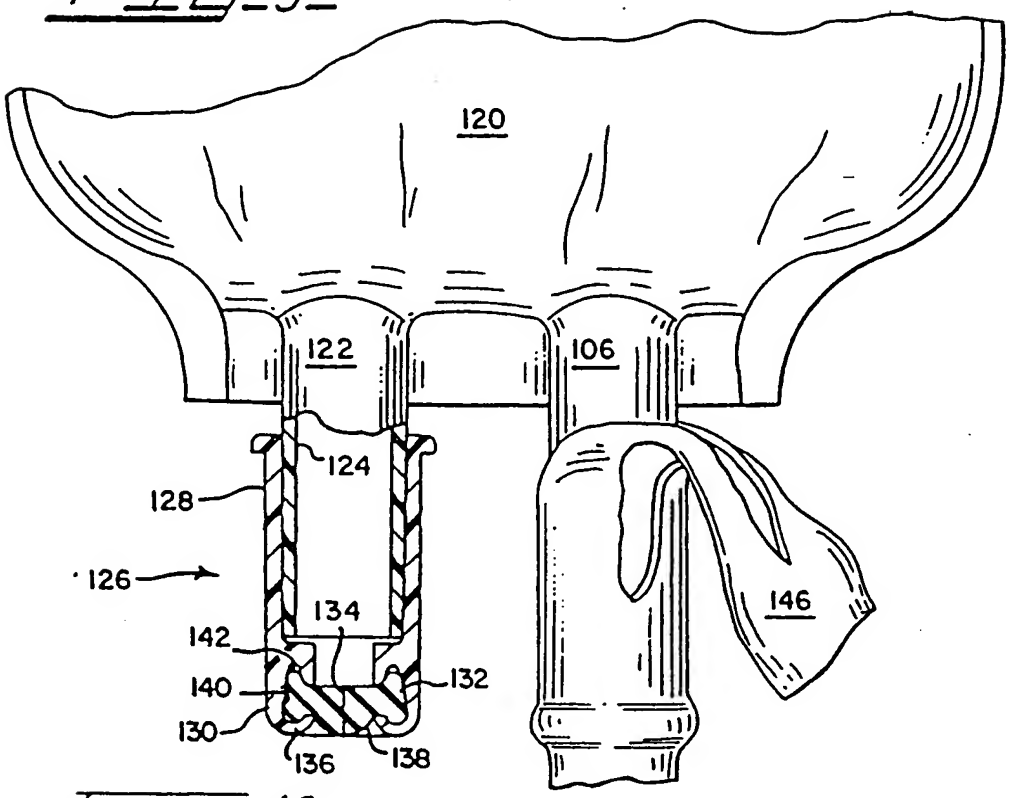

120
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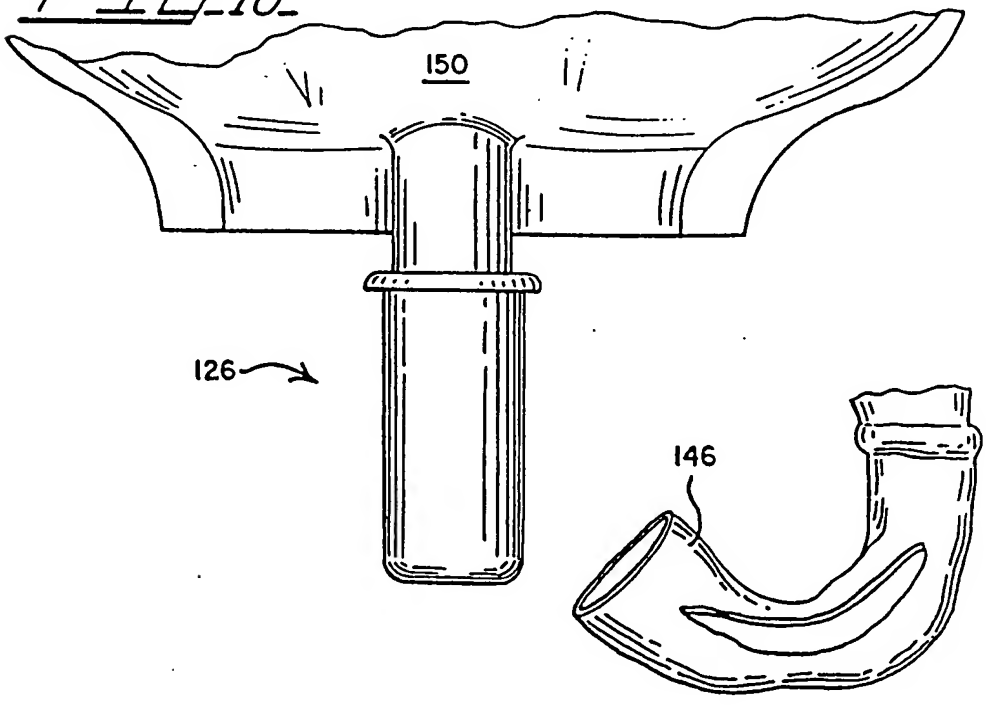
FIG-10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126
146

FIG_11_

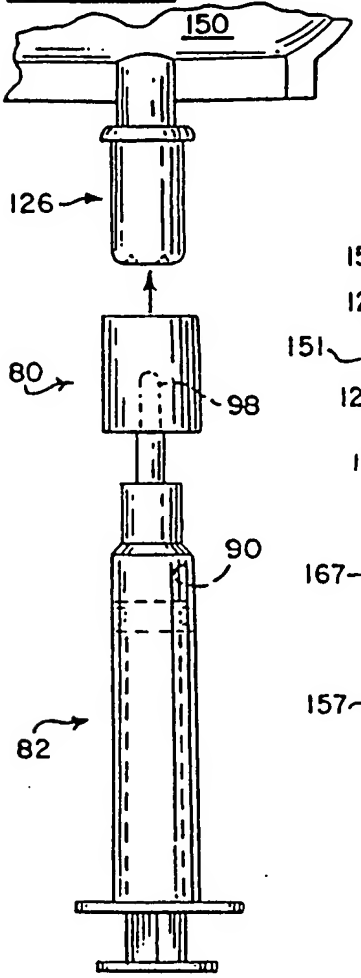


FIG_12_

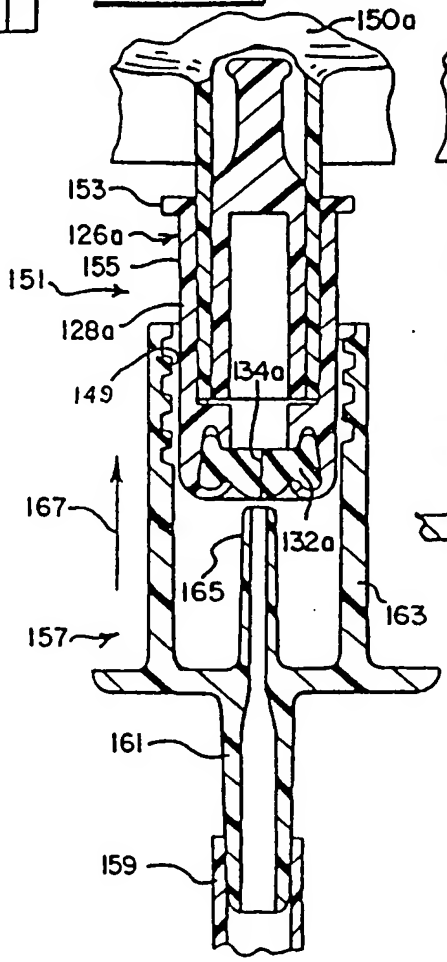


FIG_13_

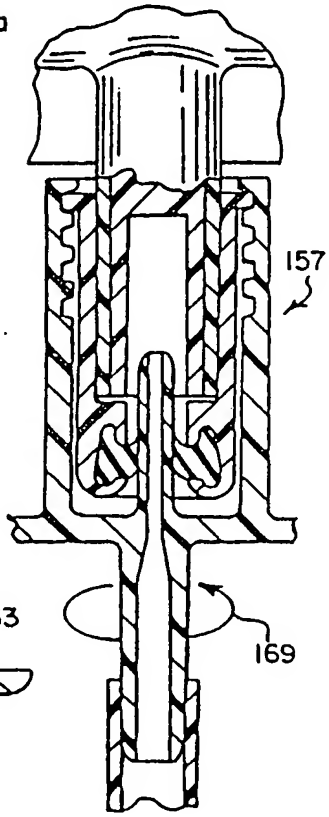


FIG_14_

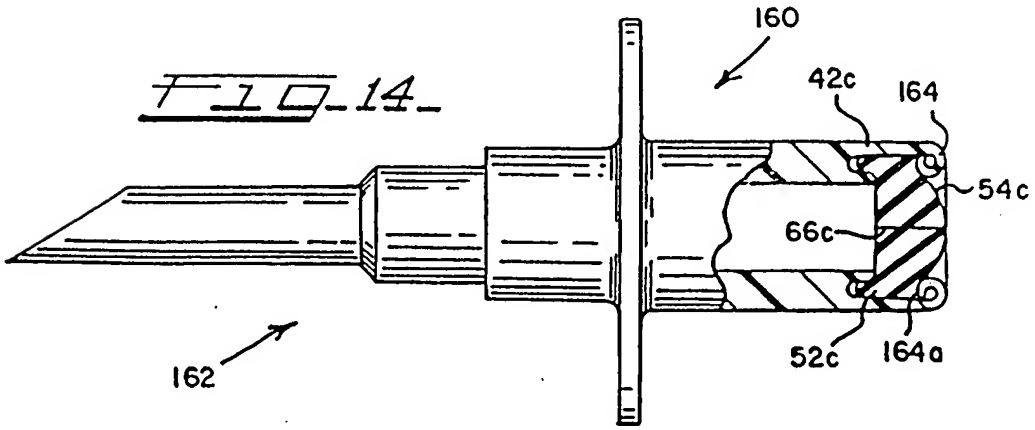


FIG. 15

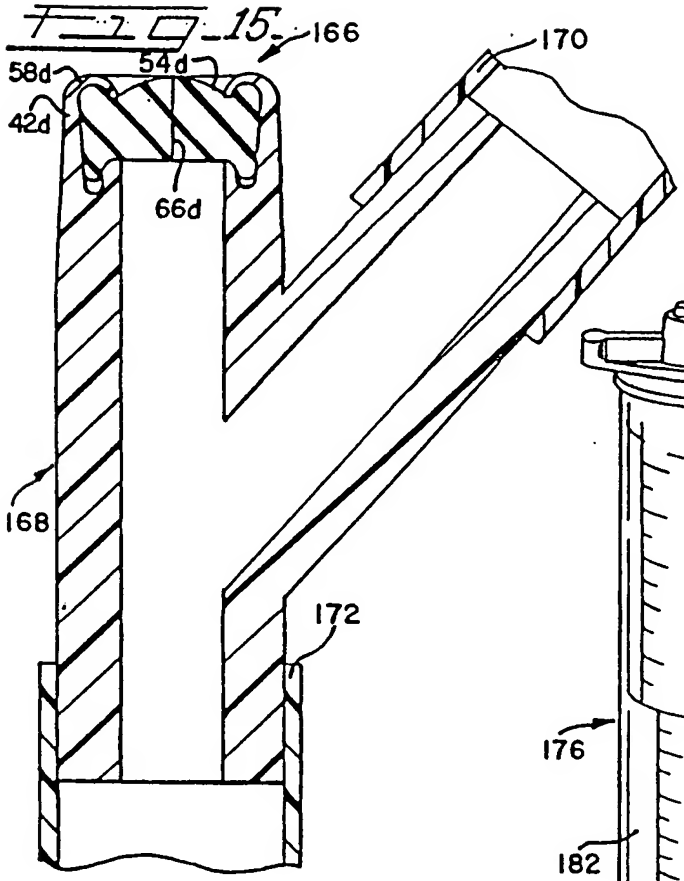
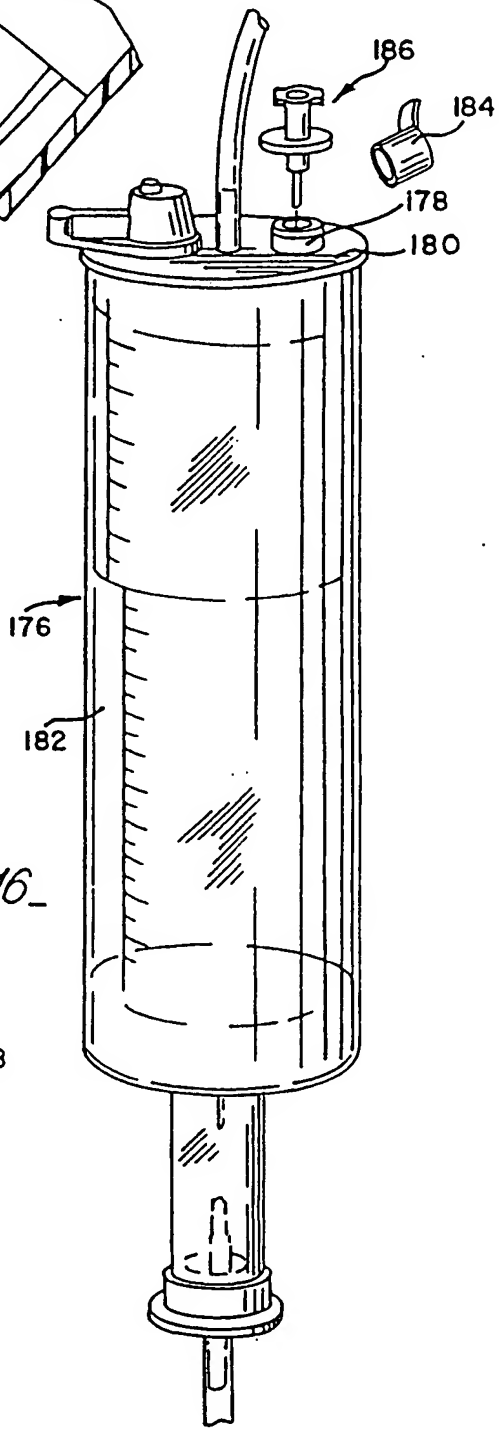


FIG. 17



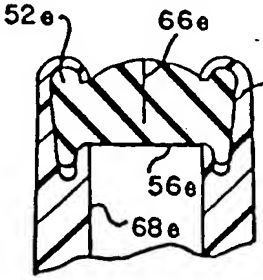


FIG. 16

FIG. 18

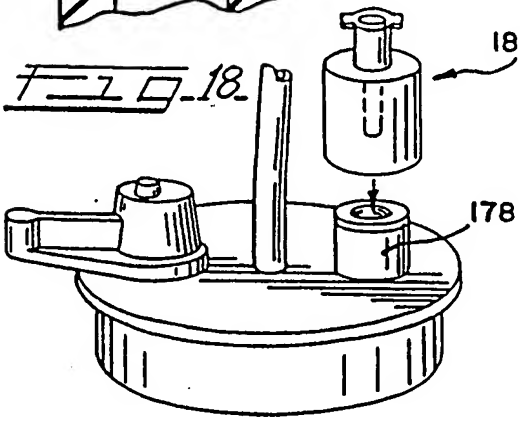


FIG. 19

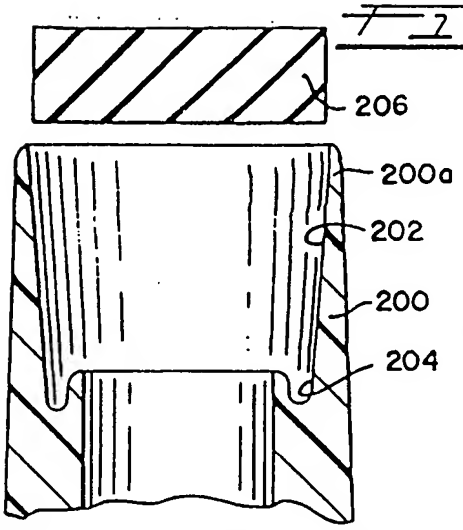


FIG. 20

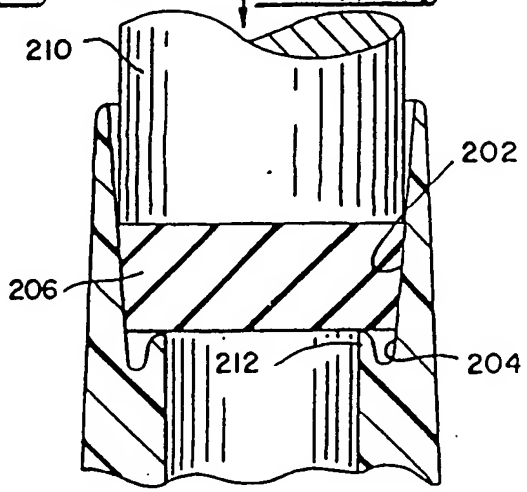


FIG. 21

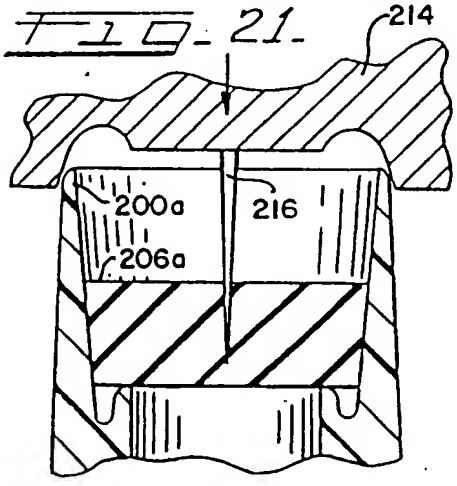


FIG. 22

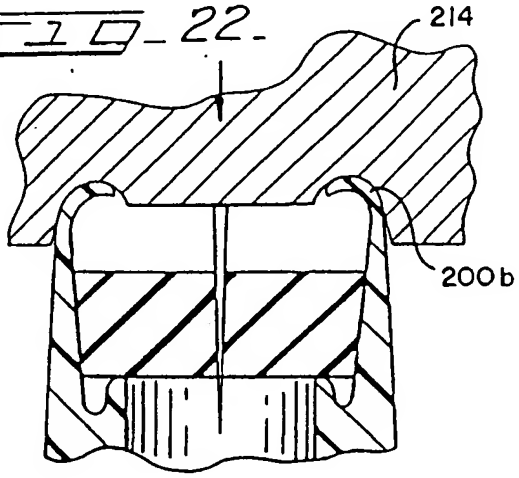


FIG. 23

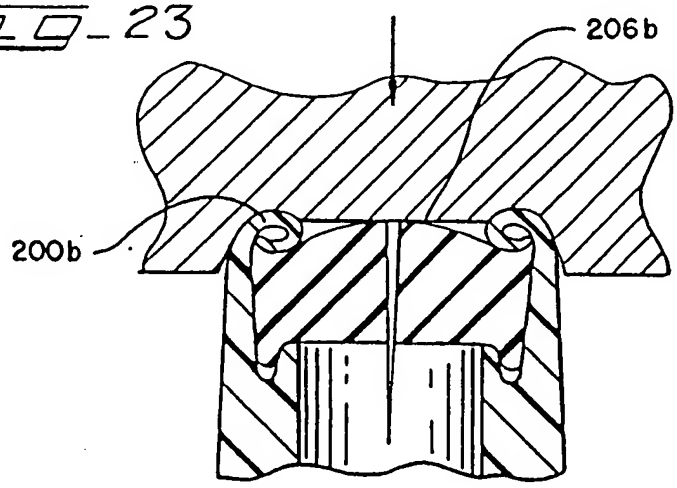


FIG. 24

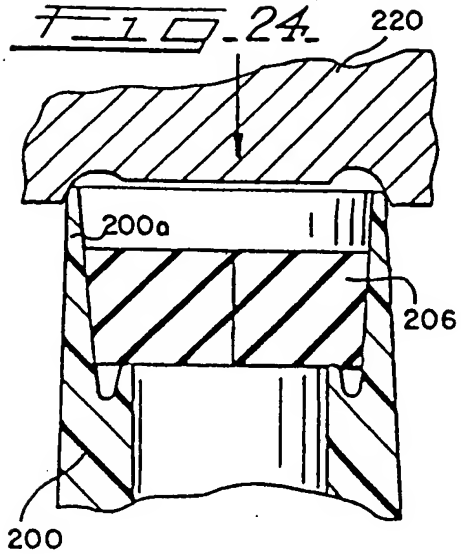


FIG. 25

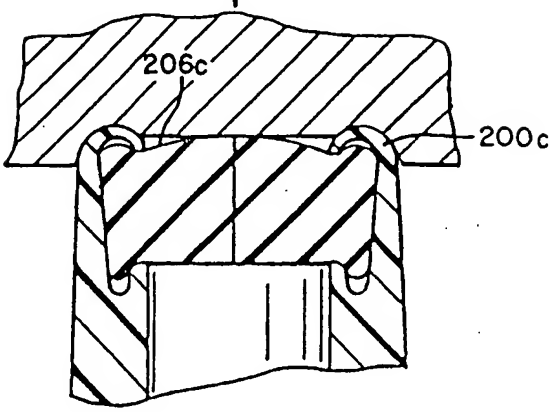


FIG. 26

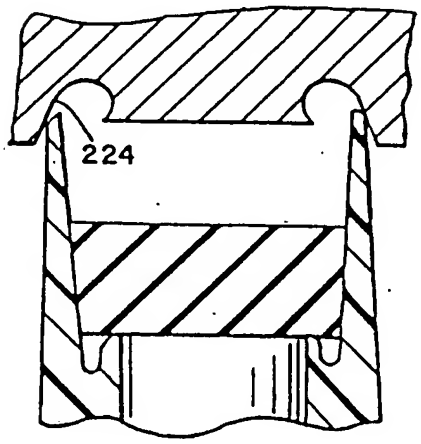


FIG. 27

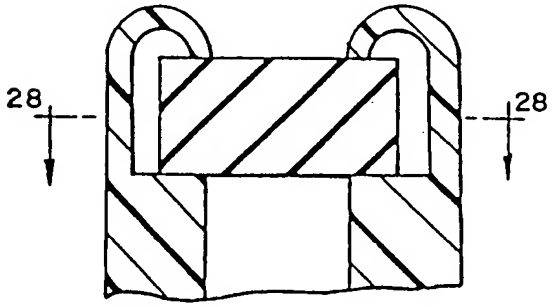
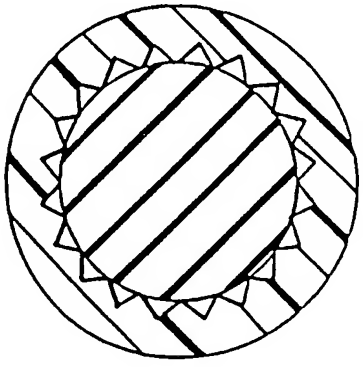


FIG. 28



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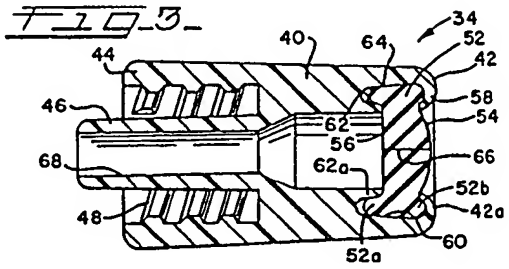
(54) Injection site.

(57) The injection site is usable with a blunt cannula and comprises a pre-slit septum (52) held in a housing (40). An end (42) of the housing is formed so as to serve as a retaining member and exerts axially directed forces on the septum to force its exterior surface (54) into an easily wipable domed shape. The housing also interacts with the septum to force the slit (66) into closed condition.

FIG 3



EP 0 544 653 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 20 0503

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	EP-A-0 111 723 (INTERMEDICAT GMBH) * page 6, line 1 - line 13; figure *	1-7, 12-13,15	A61M39/04
Y	FR-A-2 539 303 (TERUMO CORP.) * page 8, line 23 - line 33; figure 5 *	1-7, 12-13,15	
A	DE-A-3 627 978 (VEB KOMBINAT MEDIZIN- UND LABORTECHNIK) * column 3, line 54 - line 59; claims 1,4; figure 2 *	1,15-16	
A	DE-C-3 303 718 (B. BRAUN MELSUNGEN AG) * claims 1,5,8,10-11; figure 1 *	1-2, 15-16	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			A61M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 JUNE 1993	MIR Y GUILLEN V.

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